leaving a trail like a narrow cloud for some length of time. Thunder at Pepeekeo, May 1. Snow on Mauna Loa 21st. Heavy surf 15–19, 23–28.

The rainfall of 1902 was extraordinary in amount in all districts, Naalehu and Hilea in Kau and Waiawa in Kauai being the only exceptional stations, while at some points the rainfall was more than twice the normal.

Figures in black type indicate that one or two months are missing from the year's record, but are interpolated from adjacent stations. Where three or more months are lacking the station is omitted from this list.

Mean temperature table for May, 1903.

Stations.	Elevation.	Mean max.	Mean min.	Cor. av'ge.
	Feet.	°	°	°
Pepeekeo	100	76.8	68.3	71.9
Hilo	40	84.3	66.5	74.7
Kohala	521	77.5	65.6	70.9
Waimea	2,730	70.4	58.3	63.7
Waiakoa	2,700	83.6	55.9	69.0
United States Magnetic Station	50	83.8	67.1	74.8
United States Experimental Station	350	80.6	68.5	74.2
Waikiki	15	80.8	70.5	75.0

HIGH WINDS AT POINT REYES LIGHT, CAL.

By Mr. W. W. THOMAS and Prof. A. G. MCADIE.

Mr. W. W. Thomas, Observer, Point Reyes Light, Cal., through Prof. Alexander G. McAdie, communicates tables and charts comparing together the wind velocities during two memorable gales at the former station in May, 1902, and 1903. He adds: "It is believed that the record of an average hourly movement of the air, exceeding 50 miles per hour, for a period of nine consecutive days (May 13–23, 1903) is unparalleled in the records of the Weather Bureau." Professor McAdie says: "I have added a few notes giving the air movement at Point Lobos, Cal., San Francisco, Mount Tamalpais, and Southeast Farallon, as the grouping of the stations makes it possible to discuss the air movement at sea level, on the ocean, a little above sea level on headlands, and at a height of half a mile on Tamalpais."

Two memorable northwest gales at Point Reyes Light, Cal.

Date.	Average velocity, miles per hour.				Daily movement.		Maximum velocity.	Extreme velocity.	Time of maximum velocity.
	0 to 6 a.m.	6 a.m. to 12 noon.	12 noon to 6 p.m.	6 p.m. to 12 midnight.	Total.	Average hourly.			
1902.					*Miles.*	*Miles.*	*Miles.*	*Miles.*	
May 13	7	4	11	10	188	8	16	16	....
14	11	14	12	22	347	14	28	30	....
15	29	31	31	36	756	31.5	45	50	....
16	39	38	46	58	1,086	45	76	80	10:30 p. m.
17	64	54	67	78	1,580	66	90	96	7:00 p. m.
18	75	70	79	88	1.876	78	110	120	8:50 p. m.
19	59	45	59	64	1,360	57	75	80	7:00 p. m.
20	40	27	31	52	905	38	57	62	10:45 a. m.
21	34	12	11	22	474	20	48	50	12:50 a. m.
22	21	7	9	12	291	12	27	29	....
23	17	7	10	15	287	12	26	30	....
1903.									
May 13	13	9	11	35	410	17	48	50	10:15 p. m.
14	51	39	47	55	1,153	48	64	66	9:00 p. m.
15	43	44	63	78	1,371	57	89	93	7:55 p. m.
16	72	60	65	82	1,673	70	94	98	9:55 p. m.
17	62	42	51	67	1,339	56	89	92	12:05 a. m.
18	58	52	48	59	1,247	52	68	70	12:10 a. m.
19	45	45	47	50	1,124	47	60	62	12:15 a. m.
20	42	42	50	50	1,103	46	58	60	3:50 a. m.
21	47	47	53	57	1,227	51	64	66	8:45 a. m.
22	42	39	39	45	986	41	59	61	11:30 a. m.
23	47	19	18	30	679	28	52	54	12:45 a. m.

As the diagram accompanying Mr. Thomas's communication is but little more instructive than the tabular data, we refrain from publishing it; the proper fractions given by Mr. Thomas have been omitted as the nearest whole figure is sufficient; the maximum hourly velocities are the averages for five minutes; the extreme hourly velocities are deduced from the records for single miles. The table referred to by Professor McAdie will be found on page 220.—*C. A.*

LANTERN SLIDES.

Dr. O. L. Fassig communicates the following list of lantern slides that he has had made for his lectures on meteorology at Baltimore, Md. Duplicates of the slides marked "n" (negatives) can be furnished those who desire them at the rate of 25 cents each; a negative and slide will cost 50 cents. If any item includes many slides the corresponding number is given.

1. Whirling alto-stratus.
1 n. Umbrella cloud. MONTHLY WEATHER REVIEW. 1902.
1 n. Diurnal barometric wave, North America and South America.
1 n. Diurnal barometric wave, path of center.
1. Solar halo, Columbus, Ohio.
1 n. Cluster of snow crystals.
2. The "Umbria" after a snowstorm.
2 n. Effect of heavy snow on trees.
1 n. Effect of hailstorm on corn field.
1. Distant view of tornado.
1 n. Fake tornado.
2 n. New Richmond tornado.
1 n. Louisville tornado, March 27, 1890.
3 n. West Indian hurricane, 8 a. m., August 7, 8, and 13, 1899.
1 n. Galveston hurricane, September 8, 1900. (Isobars.)
1 n. Typical storm area, February 28, 1902, 8 a. m.
3 n. Typical Gulf storm, February 20, 21, and 22, 1902.
3 n. Typical Lake storm, December 24, 25, and 26, 1902.
1 n. Storm tracks and storm frequency.
2 n. Storm tracks, January and February, 1903, United States.
1 n. Daily weather map, United States. Typical low area in Mississippi Valley.
1 n. Paths of highs and lows across the United States with rate of progress.
1 n. Flat map, June 15, 1896, 8 a. m.
1 n. Normal temperatures in United States, January.
1 n. Normal temperatures in United States, July.
3 n. Baltimore daily weather, 1871–1902; February 22, March 4, and July 4.
1 n. Baltimore normal daily temperature; average maximum, minimum, and barometer.
1 n. Baltimore temperatures; daily ranges and extremes.
1 n. Baltimore monthly temperature departures, 1817–1902.
1 n. Diurnal variation of temperature at Baltimore on clear, cloudy, and rainy days.
1 n. Relation between temperature and wind direction January, April, July, and October, at Baltimore.
1 n. Diurnal and annual changes of wind velocity at Baltimore.
1 n. Diurnal variation of temperatures at Baltimore as affected by wind velocity.
1 n. Baltimore rainfall probability; 5-day means, daily and average amounts.
1 n. Normal daily temperatures at Baltimore, April 20–June 28.
1 n. Sun-spot frequency and temperatures at Baltimore.
1 n. Unusual succession of rainy Sundays, Baltimore, September, 1902, to February, 1903.
6. Fog billows, San Francisco, Cal.
1 n. The moon and the weather.
1 n. The coronal period and meteorological and magnetic phenomena.
1 n. Sun-spot frequency and temperature, rainfall, hail, and vintages.
1 n. Sun-spot frequency and magnetic declination.
1. Marvin's kite meteorograph.
22. Typical cloud forms.
1 n. Typical cumulus. Hann.
1 n. Thunderhead, Java.
1 n. Typical cloud forms arranged in order of occurrence. (Inward.)
4 n. Hail clouds.
1 n. Ideal cross section of hail cloud.
4 n. Hail stones.
1 n. Hail shooting in Italy.
1 n. An aurora, Germany, eighteenth century.
1 n. Solar halo and mock suns.
1 n. Solar halo, seventeenth century.
25. Snow crystals.
1. Snow under the equator.
1. Lightning flashes.
1. Tree struck by lightning.
1 n. Approaching tornado. Frank Leslie's Weekly.
1 n. Tornado, Germany, sixteenth century.
1 n. Waterspouts, Florida coast.
1 n. Sun-spot frequency and June temperature at Bremen.
1 n. Rynmann's Wetterbuchlein. Edition of 1510, Augsburg.

1 n. Rynmann's Wetterbuchlein. Table of contents, edition of 1510, Munich.
1 n. Bauern Praktik. Munich, 1512.
1 n. Die Bauern Praktik. Edition of 1508, first page.
1 n. Practica auf das Jahr 1502.
1 Famine areas in India.
3 n. Baltimore weather, 1871-1902; May 1, September 12 and December 25.
1 n. Baltimore rainfall. Daily frequency, 1871-1900.
1. Diurnal temperature curve for Baltimore for the year.
1. Kite flight at Blue Hill Observatory.
1 n. Cyclone prognostics. Abercromby.
1 n. Typical storm at sea, North Atlantic Ocean.
4 n. Storm tracks for February, April, July, and October, in the United States, ten years.
4 n. Cold wave, February 11, 12, 13, and 14, 1899.
1 n. Typical high area, fair weather, September 14, 1902.
1 n. Type of fair weather, February 20, 1903.

METEOROLOGICAL OBSERVATIONS OBTAINED BY THE USE OF KITES OFF THE WEST COAST OF SCOTLAND, 1902.

By W. N. SHAW, Sc. D., F. R. S., and W. H. DINES, B. A. Read before the Royal Society, London, May 14, 1903.

ABSTRACT FURNISHED FOR THE MONTHLY WEATHER REVIEW.

This paper presents the results of the first organized attempt to obtain a series of automatic records of temperature and humidity in the upper air of the British Isles or neighboring seas by means of kites. They are derived from the records of forty kite ascents in which instruments were raised, and which were carried out by Mr. Dines and his two sons, under the auspices of the Royal Meteorological Society in cooperation with a committee of the British Association, during the months of July and August, 1902. Two of the ascents were from a small island in Crinan Bay, Argyllshire, the remainder from the deck of a tug steaming in the Jura Sound or neighboring sea. Kites were raised on seventy-one occasions, but, on thirty-one of them, the force of the wind, even when assisted by the speed of the tug at seven knots, was not sufficient to raise the recording instruments. On those occasions an experimental form of registering air thermometer alone was carried. The average recorded height of ascents with instruments was 5900 feet (1940 meters), and average estimated height of the seventy-one ascents 4200 feet (1400 meters); a height of 12,000 feet (3700 meters) was passed on two occasions and 15,000 feet (4500 meters) was reached once, but the record was lost owing to the breaking away of the highest kite.

The kites and winding gear were designed and constructed by Mr. Dines. Particulars as to them are given in the Quarterly Journal of the Royal Meteorological Society, vol. 29, p. 69, 1903.

The greatest angular elevation given by the kites with a short length of line was 62° 31′; the greatest height reached with one kite was 5500 feet (1700 meters), with two 9200 feet (2800 meters), with three 12,400 feet (3800 meters).

The method of dealing with the records is described and illustrated. The results are expressed on a diagram representing, by a series of points and connecting lines, the height in the air of a series of temperatures at successive intervals of 1° C. for each ascent. The diagram thus presents a series of isothermal lines referred to time and height as coordinates. So far as the observations extend, the changes in the actual and relative positions of the lines show how the temperature varied at the surface and in the upper air during the period of the experiments.

On account of the unsatisfactory nature of the hygrometric records only four stages of humidity are dealt with, and these are entered upon the diagram upon which are also recorded the observed heights of clouds entered by the kites, the direction of the wind at the surface and in the upper air, and particulars of the weather.

For the purpose of comparison the curves of variation of the barometer at Fort William and Ben Nevis, during the period of the experiments, are plotted on the same diagram, and certain particulars are also given about the temperatures of the wet and dry bulb at those stations.

From the diagram the fall of temperature for each 500 meters of each ascent is taken out and tabulated. The table gives the following average results:

Table of fall of temperature, in degrees centigrade, for each 500 meters of ascent.

Meters.	July.		August.	
	Ascents.	° C.	Ascents.	° C.
0 to 500	22	3.0	13	2.6
500 to 1,000	16	2.8	11	2.8
1,000 to 1,500	9	2.2	9	2.3
1,500 to 2,000	2	2.0	7	2.1
2,000 to 2,500	1	2.0	3	2.0
2,500 to 3,000	....	.....	2	2.0
3,000 to 3,500	....	.....	2	1.7

The range of fall for the first 500 meters varied from 4° C. to 1° C. The smallest fall was associated with an inversion of temperature gradient not far from the surface. An inversion of temperature gradient with very dry air above a layer of clouds was shown also on one of the occasions of steepest gradient near the surface. The steep gradients observed in the lower strata are shown to be associated with anticyclonic conditions preceding the approach of a depression, and by examples on five occasions it is shown that the characteristic of the passage of a depression is that the isothermal lines of the diagram open out as the depression comes on, the average diminution of gradient for the change of barometric conditions amounting to as much as 50 per cent.

The paths of the centers of depressions producing these changes are shown on the maps taken from the monthly weather reports of the meteorological office. It appears that they passed the station on all sides at various distances, but none actually crossed it. The results show that whatever was the path taken by the center the column of air over Crinan became relatively much more nearly uniform in temperature under the influence of the depression, and therefore probably represented a relatively warm column of air.

The average of the values of temperature gradients in columns of air of different heights derived from all the Crinan ascents are as follows:

Height of column. Meters.	Temperature gradient. Per 100 meters.
500	0.56
1000	0.56
1500	0.52
2000	0.50
2500	0.48
3000	0.46
3500	0.43

It must be remembered that a moderately strong wind was required for the higher ascents, and they therefore refer to a more or less special type of weather. The gradients for the higher columns are accordingly not so generally applicable as those for the lower columns.

The results are compared with temperature gradients observed elsewhere as given in Hann's Meteorologie, with the theoretical temperature gradient in dry air (1° C. per 100 meters), and with that for saturated air having an initial temperature of 12° C. The last differs but little from 0.53° C. per 100 meters for all ranges up to 2000 meters and then increases. The average Crinan gradient is almost identical with this and with the conventional correction in use in this country [England] for the reduction of temperatures to a common level, viz, 1° F. per 300 feet.

The last part of the paper is devoted to considering the differences between the temperatures as observed in the free air at the same height as the summit of Ben Nevis and those read on the mountain itself. The differences are always in favor of the free air which is shown to be on the average 2.6°